Commonwealth of Kentucky
Division for Air Quality

PERMIT STATEMENT OF BASIS

Draft Title V Permit No. V-03-040
SUPERIOR GRAPHITE COMPANY
HOPKINSVILLE, KENTUCKY 42240
January 12, 2004
SREENIVAS KESARAJU P.E, REVIEWER
Plant I.D. # 21-047-00025
Application Log # 50261/50450

A. SOURCE DESCRIPTION:

The Superior Graphite Company (Superior), Desulco Division, manufactures and processes high purity graphite (Desulco), synthetic graphite, natural graphite, and silicon carbide at its Hopkinsville, Kentucky plant. Desulco is a high purity carbon additive that is manufactured by removing sulfur from calcined petroleum coke in high temperature furnaces.

Synthetic graphite, which is graphite produced artificially by converting petroleum coke or other high-carbon materials to a graphite structure, and other natural graphites such as flake, crystalline and amorphous graphite, are also processed in the Desulco furnaces at the Hopkinsville plant.

The raw material is transferred into the Furnaces from the pre heater. The sulfur is removed from raw material (Calcined Petroleum Coke) to produce high purity carbon additive. The flue gases contain N2, CO, H_2S and other sulfur compounds along with particulate matter (unburned carbon and ash). Gases from each furnace are combined in a manifold for entry into a single afterburner that is fired with excess air to convert the H_2S to SO_2. Gases are cooled in the afterburner by excess air to 1200-1300 deg F. Then the gases pass through the Multiclone where big particulates are removed and then pass through ID fans to the scrubber via the Quench reactor. The Quench reactor scrubs a little of the SO_2 and reduces the temperature of the gases. The scrubber uses Concentrated mode Sodium based Dual Alkali technology. Soluble alkali salts are used for scrubbing the SO_2 followed by regeneration of the absorbent solution with lime. A stream of absorbent solution from the regeneration tank located at the bottom of the scrubber is sent to a hydroclone, where it is clarified and the clarified solution is returned to the bottom-most tray for recycle. The regeneration process produces gypsum or a mixed calcium sulfite/sulfate solid waste that is landfilled.

Silicon carbide grain is manufactured by reacting high purity carbons with silica in the Desulco furnaces, mainly in furnaces 16-01 and 16-02, which vent out the baghouse. The silicon carbide grain produced is processed to produce silicon carbide powder; this process mainly consists of three basic operations: milling, leaching and drying.

In the milling process silicon carbide grain will be manually loaded into three ball mills, water wil be added and the mills will be operated for approximately 24 hours. During the loading, fugitive dust will be released which is captured by hoods and then ducted to a baghouse. During the wet milling process the only emissions are small amounts of hydrogen gas. After milling, the silicon carbide slurry will be transferred to the leaching process, and no emissions will occur during this transfer operation.

Tanks will be used in the leaching process. The milled slurry will be loaded into a tank and sulfuric acid at 50 percent concentration will be pumped from 15-gallon tote tanks in to the tank. The acid will react with metallic iron, an impurity from the milling operation, to form ferric sulfate. Next, hydrofluoric acid at a 70 percent concentration will be added to the tank. The HF acid is stored outside in drums and the gaseous fluoride emissions from the transfer operations are uncontrolled. Once the HF acid is in the tank, it will remove any free silica and surface oxides from the silicon carbide. A caustic scrubber will control emissions of sulfuric acid and gaseous fluoride from the leaching tanks with a design efficiency of 99 percent. Following the acid leaching the material will be washed with deionized water. The emissions of air pollutants from leaching process will only occur during the first day of operations or when the acids are being used. The spent acids, wash waters, and caustic scrubber water will be pumped to spent acid storage tanks. The slurry will then be dried and transferred into buckets via a vibrating screen. The particulate matter generated will be controlled by baghouse.

PSD/Title V application:

This permit is being issued as a combined PSD and Title V permit. Superior has submitted a Title V application on December 15, 1997. A Title V application submittal was required because Superior is a major source for SO_2 (PTE > 100 TPY).

During the March 12, 1997 inspection by the Division for Air Quality (Division), Superior performed a source test to measure the particulate (All the particulate is considered as PM10) and SO_2 emissions. It was found that Superior has exceeded the synthetic minor particulate limit set in the permit O-90-074 (Revision 1). The Division has issued a Notice of Violation for modifying and operating furnaces 16-04 an 16-05 (Two of the five furnaces) without a PSD application and an approved PSD permit pursuant to 401 KAR 51:017. The furnaces 16-04 and 16-05 had particulate emission limits set on them to stay below the 15 TPY of PM10 significant emission rate.

On March 24, 1998, Superior submitted a PSD application requesting modifications of the current facility wide operating permit. The modifications include an increase in annual raw material coke feed rate to 19,200 pounds per hour, and increase in the particulate emission limit to 19.2 lb/hr from the scrubber stack (four furnaces operating through the scrubber). The proposed modification will increase the particulate emissions 72.73 tons per year, which is more than the PM10 significant level, and therefore subject to a PSD review.

The throughput and the hours of operation of furnaces 16-01 and 16-02 are restricted to net out of PSD review for SO_2 with the SO_2 emission reductions [106.65 TPY of SO_2 emissions reduction] being used to offset the increased SO_2 emissions at furnaces 16-03, 16-04 and 16-05.

B. COMMENTS:

1. <u>Type(s) of control and efficiency</u>:
   See BACT discussion below for details.

2. <u>Emission factors and their source:</u>

- The emissions from product handling, raw material handling and unloading are calculated using AP-42 emission factors (Chapter 11.19.2).
- The emission estimate from the furnaces and Wet Control system are based on Stack test performed by Superior.

3. <u>Applicable Regulations</u>
   (i) 401 KAR 51:017, *Prevention of Significant Deterioration of air quality*, applies to the

following emission points -

Raw Material Unloading (No Stack)
Raw Material Handling (Controls: Bag House Dust Collector 8-02)
Product Handling (Controls: Bag House Dust Collector 8-01)
Desulco Furnaces 16-01 or 16-02 [1] (while venting through scrubber), 16-03, 16-04 and 16-05 (Controls: New Dual Alkali Wet Scrubber System)

Regulation 401 KAR 59:010, *New Process Operations,* also applies to each of these emission points. However, the mass emission standards for particulate matter prescribed by 51:017 are more stringent than those under 59:010. Hence, the mass emission standards for particulate matter under 401 KAR 59:010 are superseded by 401 KAR 51:017 for every emission point listed above. The opacity standard under 401 KAR 59:010 continues to apply.

(ii) 401 KAR 59:010, *New process operations*, applies to the following emission points -

Desulco Furnace 16-01, 16-02 (While venting through Desulco Furnace Dry Control System 8-03)
Research Graphite Furnaces (Controls: Baghouse Dust Collector or Scrubber)
Furnace Maintenance (Vacuum Cleaner 8-06)
Lime Silo
Product Packaging
Limestone Silo (Stack P-4)
Welding Operation
Silicon Carbide Ball Mills
Vibratory Screen and Packaging
Eight 1000-gallon Leaching Tanks
Hydrofloric Acid Handling
Acid Handling and Leaching
Three Spent acid storage tanks
Sulfuric Acid Bulk storage
Lime Hopper and Lime slurry mixing tank

(iii) 401 KAR 59:105, *New Process Gas Streams,* applies to the following emission points -

Desulco Furnaces 16-01, 16-02[1] (While venting through the scrubber), 16-03, 16-04 and 16-05 (controls: New Dual Alkali Wet Scrubber System)

C. PSD REVIEW:

1. <u>Applicability</u>:
For the proposed modification of increasing the process rate, the net emissions are calculated as though construction had not yet commenced on the affected facilities. The net emissions increases are calculated as Net Emissions Increase = Future Allowable. According to 401 KAR 51:017, Section 17(4), any source constructed after August 7, 1980 which seeks to relax limitations originally in place to avoid PSD must perform the appropriate BACT, air quality, and other impact analysis as if construction has not yet commenced on the source or modification. Three (16-03, 16-04 and 16-05) of the five furnaces are constructed after August 7, 1980, and had limits in place, which allowed the sources to avoid PSD at the time of

1 Only one of the furnaces 16-01 or 16-02 can vent through the Wet Scrubbing system at one time

original permitting. Therefore, existing emissions must be set to zero for the purpose of net emissions increase calculations.

The three furnaces mentioned above are run through the Wet Scrubber System (Scrubber) to control SO_2 and particulate. The furnaces 16-01 and 16-02 are run through the Bag house to control particulate. There is no control for SO_2. Superior with this modification is proposing to reduce the number of hours of operation of 16-01 and 16-02 while running through the Baghouse and run furnace 16-01 or 16-02 through the Wet Scrubber System (total of four furnaces through the scrubber). Therefore, the particulate emissions increase from the modification is equal to the maximum proposed allowable emission rate from the four furnaces (16-01 or 16-02[1], 16-03, 16-04 and 16-05) combined.

Thus the particulate emissions increase from the modification is 72.73 tons per year, which is more than the PM10 significant emission rate of 15 TPY, and therefore subject to a PSD review. The net SO_2 increase from this modification is -1.67 TPY and is less than the significant emission rate of 40 TPY.

The Superior Graphite facility (SIC 2911, Desulfurized Petroleum Coke and 3297, Granular Synthetic Graphite) falls under one of the 28 listed major source categories under PSD and is located in a county classified as attainment or unclassifiable pursuant to Regulation 401 KAR 51:010. The facility is currently a major source of SO_2, a criteria pollutant, i.e., emissions of SO_2 greater than 100 TPY.

A PSD review involves the following six requirements:

i. Demonstration of the application of Best Available Control Technology (BACT).
ii. Demonstration of compliance with each applicable emission limitation under 401 KAR Chapters 50 to 63 and each applicable emission standard and standard of performance under 40 CFR 60 and 61.
iii. Air quality impact analysis.
iv. Class I area(s) impact analysis.
v. Projected growth analysis.
vi. Analysis of the effects on soils, vegetation, and visibility.

This review demonstrates that all regulatory requirements will be met and includes a draft permit, which establishes the enforceability of all applicable requirements.

2. PSD Modifications

The draft permit will authorize the following proposed modifications that are subject to a PSD review:

i. Increase in the annual production capacity from 49,995 tons to 64,995 tons of Desulfurized coke (Desulco).
ii. One of the furnaces 16-01 and 16-02 can vent through the Wet scrubber. The total annual raw material input for four graphite furnaces (16-01 or 16-02 [1], 16-03, 16-04, and 16-05) while exhausting through the wet scrubber system will increase from 54,000 tons to 72,000 tons.

1 Only one of the furnaces 16-01 or 16-02 can vent through the Wet Scrubbing system at one time

iii. A change in the allowable from existing synthetic minor particulate limit of 6.39 lb/hr (Combined for Furnaces 16-03, 16-04 and 16-05) to PSD BACT emission limit of 19.2 lb/hr (Combined for Furnaces 16-01 or 16-02[1], 16-03, 16-04 and 16-05) is requested.

iv. Addition of a new operating scenario, where the fourth furnace (Furnace 16-01 or 16-02) will exhaust through wet scrubber system.

3. PSD Pollutants

The table below lists the net significant change in emissions for all PSD regulated pollutants.

Pollutant	Emissions after Proposed Modifications (tpy)	Emissions @ Title V or pre-PSD Level (tpy)	Net Change due to Proposed PSD Modifications (tpy)
Criteria Pollutants			
SO_2	418.18	419.85	-1.67
NOx	1.56	0	1.56
CO	73.87	0	73.87
VOC	7.78	0	7.78
PM_{10}	72.73	0	72.73

The annual emissions presented in this table reflect operation of the facility for 7500 hours per year and were calculated based on maximum hourly emission rates after controls (the level of control required was determined through a BACT analysis, see C. 4. BACT Review). As seen from the table above, the proposed modification will be subject to a PSD review for PM_{10}.

4. BACT Review

Pursuant to State Regulation 401 KAR 51:017, Section 9 (1) and (3), a major stationary source subject to a PSD review shall meet the following requirements,

i. The proposed source shall apply best available control technology (BACT) for each pollutant that it will have the potential to emit in significant amounts.

ii. The proposed source shall meet each applicable emissions limitation under Title 401, KAR Chapters 50 to 63, and each applicable emission standard and standard of performance under 40 CFR 60 and 61.

The proposed source will result in emissions of particulate matter (PM_{10}) at levels that exceed PSD significance emission rates. Therefore, particulate matter emissions shall be subject to a BACT review.

Superior has presented, in the permit application, a study of the best available control technology for PM_{10} for each unit affected by the proposed modification. The Division has reviewed the proposed control technology in conjunction with information available in U.S. EPA's RACT/BACT/LAER Clearinghouse and the BACT/LAER Information System (BLIS) database. A summary of the proposed control technology is presented below.

Stack ID	Affected Facility	Pollutant	Control Technology	Control Level	Emission Level (lb/hr)
01	Raw Material Unloading Equipment	PM/PM_{10}	None	-	BACT emission limit of 0.0014 lb/ton
03	Product Handling Equipment	PM/PM_{10}	Baghouse	99.6%	0.096
04	Raw Material Handling Equipment	PM/PM_{10}	Baghouse	99.6%	0.096
05	Graphite Furnaces 16-01or 02[1], 03, 04, and 05 (Wet Control System)	PM/PM_{10}	Wet Scrubber/Mist Eliminators/Rotary Atomizers	See Note 1	BACT emission limit of 19.2 lb/hr from all four furnaces

Note 1: Wet scrubbing system, Mist Eliminator, Rotary Atomizer, Mist Eliminator combination is used to control PM/PM_{10} emissions. However, the Wet Scrubbing System by itself generates PM/PM_{10} emissions. The PM/PM_{10} generated by the scrubber was not quantified. Thus the control level has not been established.

Note 2: There are no other applicable particulate matter emissions limitations under 401 KAR Chapters 50 to 65, or under 40 CFR 60, 61 and 63 for the affected facilities listed above.

A. BACT for Raw Material Handling/Product Handling

Superior currently operates two separate baghouses, one to control emissions from raw material handling operations, and the other to control emissions from product handling operations.

The Raw Material Handling consists of the following Emission Units:
Screw Conveyors, Bucket Elevators, Chutes, Magnetic Belt, Crushing Tower consisting of Jaw Crushers and Smooth Roll Crushers, Raw Material Storage Bins, Surge Bins, Coke Silo, Purge Vessel, Screeners, and Pre-heaters.
Bucket Elevators and Screw Conveyors transfer Raw Material to Screeners where the raw material is sorted by size. The oversized material is sent to the crushing tower and recycled to screeners. The specification size material is sent to surge bins and then to the furnace via the Pre-heaters and Purge Vessel.

The Product Handling consists of the following Emission Units:
Screw Conveyors, Bucket Elevators, Chutes, Screener, Product Bins, Bagging Equipment.

The product is transferred to Screeners by Bucket Elevators and Screw Conveyors to the Screener and then transferred to the Product Bins. The bagging equipment bags the product. The particulate emissions are collected using hooded vents (Pick up points).

Superior has proposed to use a Baghouse with control efficiency of 99.6% as the BACT for the particulate control. The Division agrees with this proposal since the environmental impact of less than 1 ton per year of particulate matter after controls from these facilities is minimal. Also, the Division has reviewed the EPA's BACT/RACT/LAER clearinghouse and found that for similar sources with particulate emissions, BACT has typically been a Baghouse.

B. BACT for Raw Material Unloading

The raw material unloading area consists of intermittent unloading of calcined coke via truck dumping into an unloading hopper. The maximum potential emissions of particulate matter from this source are 0.05 tons per year. The AP-42 emission factor for a conveyor transfer point is used for calculating the emissions (0.0014 lb/ton), which is higher than the emission factor for truck unloading (0.000016 lb/ton). Superior in its application has studied the costs for installation of an enclosed unit with a Baghouse. Superior has claimed that this approach would be economically unfeasible as the initial costs would be in excess of $50,000 per ton of particulate matter and that it is also not feasible due to the nature of the activity and the level of emissions. The Division agrees with Superior's analysis. BACT for this operation will be the emission limit of 0.0014 lb/ton of coke unloaded.

C. BACT for Desulco Furnace Operations (Furnace 01 or 02, 03, 04, and 05)

Superior manufactures and processes high purity graphite (Desulco) in the Desulco Furnaces. Prior to the PSD application only three furnaces were allowed to exhaust through the existing scrubber system. Superior proposed a modification with the current PSD application. The proposed modification will allow a maximum of four furnaces to exhaust through the existing scrubber system.

Brief Process Description of Furnace Operations:

Desulco is a high purity carbon additive that is manufactured by removing sulfur from calcined petroleum coke in high temperature furnaces. These furnaces, which operate at temperatures exceeding 5000 degrees F, remove other impurities such as ash, hydrogen, carbon, oxygen, and moisture along with the sulfur. Desulco is used throughout the iron and steel industry as a carbon additive, an inoculate, or a high purity metal cover.

The raw material is transferred into the furnaces from the pre heater. The sulfur is removed from raw material (Calcined Petroleum Coke) to produce high purity carbon additive. The flue gases contain N2, CO, H_2S and other sulfur compounds along with particulate matter (unburned carbon and ash). Gases from each furnace are combined in a manifold for entry into a single afterburner which is fired with excess air to convert the H_2S to SO_2. Gases are cooled in the afterburner by excess air to 1200-1300 deg F. Then the gases pass through a Multiclone where big particulates are removed and then pass through ID fans to the scrubber via a Quench Reactor. The Quench reactor scrubs a little of the SO_2 and reduces the temperature of the gases. Then the gases are routed to the scrubber. The scrubber uses Concentrated mode, Sodium based Dual Alkali technology. Soluble alkali salts are used for scrubbing the SO_2 followed by regeneration of the absorbent solution with lime. A stream of absorbent solution from the regeneration tank located at the bottom of the scrubber is sent to a hydroclone, where it is clarified and the clarified solution is returned to the bottom most tray for recycle. The regeneration process produces gypsum or a mixed calcium sulfite/sulfate solid waste that is landfilled.

Permitting Background for the furnaces:

The **graphite furnaces 01 and 02** were constructed pursuant to the permit C-76-74 and were required to have a baghouse as control equipment to control the particulate matter. There is no control for SO_2 emissions. These furnaces were never modified after the construction. However, with the current proposal, Superior has taken limits on usage of these two furnaces through the baghouse and used the SO2 emissions reductions to net out of PSD review for SO_2.

The **graphite furnaces 03, 04 and 05** are constructed pursuant to construction permits C-79-72, C-86-195 and C-89-049 respectively and were required to have a scrubber as control equipment to reduce the SO_2 emissions and to meet regulation 401 KAR 59:105, New Process Gas Streams. All the three furnaces 03, 04, and 05 currently exhaust through the new scrubber, emission point NS. This wet scrubber system utilizes concentrated mode, sodium based dual alkali technology for SO2 control, while employing a combination of mechanical collection for particulate control. The scrubber itself generates particulate matter. The scrubbing liquor used is a concentrated mode sodium based alkali and after reacting with SO2 produces sodium bisulfate, which precipitates out at high concentrations and gets carried into the exhaust plume. The furnaces 03, 04 and 05 had synthetic minor limits on them to avoid the PSD review for particulates. The stack test performed by Superior on the scrubber showed exceedances of the synthetic minor limits for particulates and therefore the PSD application is submitted.

Superior has submitted a BACT analysis for the particulate matter emissions from the furnaces. The RBLC database was researched by Superior to find controls for particulate from a similar facility (i.e. Production of high-purity graphite by removal of sulfur in calcined coke in high-temperature furnaces). No similar facilities were found in the database after researching the BACT determinations that have been performed since 1981. In the absence of similar operations for comparison, Superior has presented the combination of the wet scrubbing system and mechanical collection as BACT for particulate matter emissions from the facility. A detailed technological analysis of the existing wet scrubber system for SO2 control with mechanical collection for particulate control and its advantages over the other control technologies available has been presented.

The premise for Superior's particulate BACT analysis is that the potential uncontrolled SO2 emissions from the plant far exceed the potential uncontrolled PM10 emissions and the technology selected for the particulate control should be able to work in conjunction with the technology selected for SO2 control (existing dual alkali scrubber). Superior has submitted information on the Dual Alkali Scrubber and its effectiveness in controlling SO2 emissions with 98+% efficiency. The primary criteria for the selection of the dual alkali scrubber system for SO2 were, a.) Capability of achieving control efficiency of 98% over an inlet SO2 range of 2500 to 6000 ppm, b.) Non scaling scrubber operation, c.) Dry waste, and d.) Proven design concepts. Superior selected and operates the dual alkali scrubber based on the above criteria for SO2 removal.

Considering the environmental impacts of SO2 and PM10, since the SO2 emissions (4200 TPY uncontrolled, 104.98 TPY with 97.5% control) are far higher than PM10 (With BACT emission limit, the particulate emissions will be 71 tons per year), the Division has accepted the permittee's proposal of using the Dual Alkali Scrubber to be a control for SO2, and choosing PM10 BACT to be able to work in conjunction with the Dual Alkali Scrubber.

The several control technologies presented for particulate collection are:
a. Fabric Filtration
b. Electrostatic Precipitation
c. High Energy Wetscrubbing (Rotary Atomizer)
d. Mechanical Collection (Multiclones)

The possible approaches for particulate collection with one or more of the above technologies are:

Fabric Filtration:
A fabric filter (baghouse) either alone or in combination with an upstream mechanical collector was not considered a technically feasible option, as the fabric filters should operate on a dry gas. The fabric filter can also be installed up stream of the wet scrubbing system. The conventional (low

temperature) filtration can only handle temperatures up to 450 F due to materials of construction of the bag. This would require that the exhaust gas from the furnace/afterburner be cooled from 1500 F.

Cooling of the exhaust gases to 450 F will create problems with the water balance of the scrubber. This reduction in temperature will reduce the evaporative losses in the wet scrubbing system beyond the point where a water balance could be maintained.

The cooling of the gases through direct injection of ambient air will increase the costs by 2.25 to 2.5 times and also increase the oxygen levels in the gas, which would destabilize the chemistry of the dual alkali system. Both the possibilities were ruled unacceptable.

The other alternative will be using the high temperature filters. Superior has claimed that this technology has not fully been developed and the reliability of these units has not been fully demonstrated and especially not been operated on particulate similar to that at Superior. However, the Division questioned this criterion of Proven Design Concepts. The control alternative can be a innovative control technology. The high temperature filter (HTF) has been in use for past 15 years and more research is being done. The Division requested a detailed feasibility analysis of the high temperature filters option, but consensus could not be reached.

The Division has contacted Mr. Richard Dennis of the Federal Energy Technology Center (FETC) at the Morgantown West Virginia office, which is a field office of the U.S. DOE. Mr. Dennis requested a meeting with Superior to see the possible application of HTF to the furnaces. After several meetings, it has been agreed that usage of High Temperature Filters upstream of the scrubber to remove coke dust and ash will reduce the particulate matter going into the scrubber and should reduce the particulates entrained in the scrubber mist. Mr. Dennis also promised Superior financial support for conceptual designs and some level of technology demonstration.

Superior has raised several issues concerning the application of high temperature filters either upstream or downstream of the afterburner. These issues included combustible gases (upstream of the afterburner), combustible coke dust (both upstream and downstream of the afterburner), particulate characteristics (both upstream and downstream of the afterburner), and reliability.

As per Mr. Dennis, the filtering upstream of the afterburner would require filters for each furnace and may not prove completely safe due to the requirements of cooling the combustible gases from the furnaces before filtering. Cooling with dilution air is unsafe due to the danger of creating an explosive gas mixture. Adiabatic cooling with water spray would be a more viable option to cool the gas, but the presence of hot carbon particles on the filter and undiluted combustible gas could be dangerous if furnace upsets occurred. However, filtering down stream of the afterburner at 1200-1300 F or below could prove to be beneficial.

While there would still be residual carbon particles downstream of the afterburner, they would be at a much lower concentration. With proper precautions in the design and operation of the filtration system such as scheduled service with proper inerting and cooling, the potential for fires can be avoided. The major causes of sticky ashes are eutectics caused by alkalis in the ash. DOE tests showed sticky ashes in high alkali coal ashes above 1,500 F in oxidizing conditions. The coke ashes are generally low in alkali. When comparing coals against petroleum cokes, the low level of alkali metals in the coke ash is apparent. Alkali concentrations in coal ash range from 2 to 3 percent, whereas alkali in coke ash ranges from null to <1 percent. Operating in an oxidizing condition below 1300 F should prevent sticky solids.

According to FETC, the reliability of ceramic barrier filters has been an issue. However, R&D sponsored by DOE and vendors has resulted in rapid improvement not only in filter element design but also in the design of the filter system itself. Several vendors now offer barrier filter systems with guarantees. While most of the industrial applications are small (<5,000 ACFM), larger filters are beginning to appear.

FETC concluded that application of a barrier filter downstream of the afterburner at 1200-1300 F or below appears feasible with proper design and maintenance. Superior and FETC have signed a Cooperative Research and Development Agreement (CRADA) to study the feasibility and costs versus benefits. FETC has performed a study at Superior and submitted a report of feasibility on the barrier filter.

The Division found several problems with the application of High Temperature Filters technology to this project as described in the report. There are several feasibility and cost effectiveness questions unanswered about the project. Based on these factors the High Temperature Barrier filters were ruled out as option. However, the Division encourages Superior to explore this technology as a possible control option for opacity that has continued to be a problem. There are no such conditions in the permit however. The reduction in coke dust and ash prior to the absorption tower will reduce the solids accumulation in the tower and will help reduce the opacity problem. This will also reduce the particulate matter emissions.

Electrostatic Precipitation:
Dry and wet electrostatic precipitators (ESPs) have been discussed. A **Dry ESP** would have to be located upstream of the dual alkali system. The principle variants are hot-side and cold-side which refers to the location relative to air pre-heaters. Hot-side ESPs are generally more efficient than cold-side and have the added advantage of not having to cool the gas which would impact the wet scrubber water balance. However, the resistivity of the particulate, which contains significant levels of coke, does not readily lend itself to conventional ESP even with the use of gas additives to enhance the performance. Thus the dry ESP cannot guarantee high collection efficiencies.

A single or two-stage **Wet ESP** down stream of the wet scrubber has been studied. The wet ESPs operate on saturated gas streams and utilize water for washing particulate from collector plates. The recycle water from the dual alkali scrubber can be used as wash water. But wash water has to be low in suspended solids with controlled levels of dissolved solids as well to preclude scale potential or corrosion. Dual alkali scrubbing liquor cannot be used.

If weirs are used for distributing wash water, the collector plates have to be washed continuously. The wash water requirement for application at Superior will require 50 to 200 gpm. This would create a enormous water imbalance. Thus, the weir design is not considered technically feasible.

Mechanical Collection with Wet Scrubbing – Proposed BACT

Superior operates a combination of mechanical collection (Multiclones) and high energy wet scrubbing (Rotary Atomizer) for particulate control. The Multiclones are installed upstream of the wet scrubbing system. The multiclone is a combination of small diameter cyclones. Inertial forces, specifically centrifugal forces, allow the initial collection of particulate matter in cyclones. Because the small particles are not subject to strong inertial forces, cyclones tend to not be good collectors for particles smaller than 5 microns. The collection efficiency sharply decreases as the particulate size decreases. Thus this cannot be a effective control mechanism for particles less than 10 microns. In addition, Multiclones can handle only small gas flow rates and collection efficiency is substantially reduced at low gas flow rates due to the decreased particle inertia. The exhaust from the multiclones consisting of smaller particulate is carried over into the Dual Alkali Wet Scrubbing System.

The Dual Alkali Wet Scrubbing System uses tray towers for gas-liquid contact. The tray towers were selected because of the high mass transfer efficiencies, moderate pressure drops, and ability to handle a fairly wide range in gas flow rates. SO_2 removal efficiencies of 97% are achieved with the wet scrubbing system. However, this is not an effective particulate collection device nor is it good for handling slurries. In fact, it is highly desirable that the presence of solids in the scrubbing liquors be minimized to reduce the potential for pluggage of the towers. Hence, unlike slurry scrubbers, the bulk of the particulate control must be handled separate from the SO_2 control scrubber tower.

High energy wet scrubbing (rotary atomizers) is used downstream of the dual alkali wet scrubber and demister.The atomizers use recirculated absorbent liquor, recirculated (neutralized) water, or a combination of the two. The energy imparted in these rotary atomizers to effect the mist for capturing the particulate is created by impacting the recirculating liquor on rotating disks. The rotary atomizers can also be installed in a modular fashion so there can be a spare module to accommodate the maintenance expected for this type of device. These types of scrubbers are usually effective mainly on large particulate. The exhaust stream from the dual alkali scrubber is composed of sodium sulfite, sodium bisulfite, and calcium sulfite emissions. These are generated in the scrubber, when SO2 reacts with scrubbing liquor. Rotary atomizers mainly control the scrubber generated particulate (depending on the particulate size).

The dual alkali scrubber generates liquid droplets which are entrained in the gas stream leaving the treatment area. To remove these droplets, a chevron type mist eliminator is installed upstream and downstream of the rotary atomizers. Chevrons are simply zig-zag baffles which force the gas to turn sharply several times while passing through. Water droplets are collected on the chevron blades and drain downward. These are generally limited to gas velocities of less than approximately 20 feet per second. At high velocities, liquid on the blades can be driven toward the outlet side of the chevron where it can be re-entrained in the gas stream. High velocities are usually caused by solids build-up on part of the chevron. This increases the velocities in the portion of the demister which is still open for flow. In order to minimize solids accumulation, clean water spray headers are activated intermittently. Superior uses recirculated absorbent liquor in the demisters along with clean water.

From the above analysis, this rotary atomizer is only effective for big particulate. As discussed above, exhaust from furnaces containing the unburned coal and ash (fine particulate) is carried forward into the scrubber through the multiclone. This fine particulate is not effectively scrubbed either in the dual alkali scrubber or the rotary atomizer. Thus the fine particulate is carried through the rotary atomizers, out through the demisters and the stack.

Superior also has proposed potential upgrades and modifications for enhanced particulate control. The existing equipment has been re-examined in light of the results of particulate testing and the continuing monitoring of opacity to identify possible upgrades that could improve the performance.

The modifications proposed to the existing system are:

Absorber Tower bulk entrainment separator -
Addition of a chevron type bulk entrainment separator at the top of the new absorber tower was studied. The purpose would be to remove as much mist carryover as possible to minimize that, which is carried into the rotary atomizer system. The mist is suspected to be contributing to particulate discharges because of the entrained particulate carry over. Superior installed a bulk entrainment separator in the old scrubber, but it had solids deposition and pluggage problems. Installation of a bulk entrainment separator again might create similar problems. This may also create additional strain on the water balance. This system is not selected.

Additional mist eliminator upstream of Rotary Atomizer -
Addition of second mist eliminator upstream of rotary atomizer will have additional water requirements that could exacerbate already tight water balance. Current mist eliminators already have solids deposition and pluggage problems and hence cannot be installed. This system is not selected.

Scrubber recirculation tank solids removal -
Solids continue to accumulate in the recirculation tank at the bottom of the absorber tower due to some solids removal occurring in the upstream quench (which shares the same recirculation tank). A separate tank for each quench cannot be easily effected without a complete reconfiguration of the ducting. According to Superior this would be an expensive proposition for an unproven concept. Alternatively it was proposed that solids can be removed on a continuous basis, which would reduce the particulate that is recirculated to the top tray. This would then reduce solid particulate that can be entrained and carried over to, and perhaps through, the rotary atomizers. Currently these solids are removed either through the normal purge from the absorber recirculation loop to the reactor system or from the underflow of the hydroclone on the bottom spray, which is also directed to the reactor system. There are two approaches to reducing the solids content. One is the installation of a additional hydroclone on the tower recirculation loop to continuously remove solids and direct them to the reactor system. This however was not done as the performance of the existing hydroclone was in question. The second approach to this is installation of a sludge pump to intermittently or continuously pumps sludge from the recirculation tank bottom to the reactor system. Superior is currently operating a sludge pump to intermittently pump the sludge to the primary reactor. The effectiveness of this approach has not been tested. The permit will require that Superior continue pumping from the recirculation tank using the sludge pump. It will also require that Superior install a permanent recirculation pump for the recirculation tank itself to improve the mixing of solids that tend to settle out in the bottom of the tank. This will entail installation of a line off the existing recirculation pump discharge with appropriate valving. This system has been implemented.

Additional mist eliminator downstream of Rotary Atomizer -
There are two approaches to this scenario. Scenario 1 is the installation of a full flow, Final Mesh Demister. Scenario 2 is the installation of a second mist eliminator downstream of the rotary atomizer**.**

Scenario 1: The working of a single Full flow Demisters (FFD) downstream of the scrubber was studied. The single FFD would be connected to the gas flow from all the rotary atomizer trains. Superior has submitted an analysis based on physical, chemical, and engineering principles to see the feasibility of FFD. The single blade type demister for each scrubber would not be capable of providing high efficiency over the range of flows anticipated because of the large turndown in gas flow, a factor of three to four. Mesh type demisters would be capable of operating over a wider range of gas flow. Mesh type would however be highly susceptible to pluggage and scaling, which would require frequent washing with clean water and would need to be oriented in a vertical gas flow configuration to allow adequate drainage of collected mist and wash water. Frequent water wash will create additional strain on the water balance if this water were to be discharged to the system to recover liquor and remove particulate through the solids dewatering equipment. Superior said that this would necessitate a separate water recycle treatment loop for reducing the added strain on the water balance; that would greatly increase capital and operating costs. Superior insisted that the mesh type demisters operating previously had pluggage problems, which led to replacement with blade type units. These units however are smaller units operating downstream of each rotary atomizer. The Division requested that Superior study the option of having a separate water loop for frequent washing of single FFD; This would not create additional strain on the water balance. Superior has submitted the costs for a single FFD, which included installation of equipment, project indirect costs, owner’s costs, and operating costs amounting to $3,650,000. Based on the above study, the Division has ruled this option out as it is not cost effective. This system is not selected.

Scenario 2: Superior has experimented with a second downstream demister attachment after the existing chevron type demister. It is 2-inch polypropylene mesh pad coalesced on the upstream face of this chevron type demister. Superior has been experimenting with different types of mesh pads. The first and second mesh pad designs failed due to insufficient support of the pad. The third design version was run on line for one week, removed, inspected, washed, and put back in service. After running another 12 days, Superior had to remove the mesh pad from service due to increasing pressure drop across the mesh pad. Severe plugging of the pad restricted the gas flow.

The modifications presented above did not clearly give a control option to be presented as BACT. As discussed above, Superior currently is using rotary atomizers and mist eliminators. Superior has also studied the possibilities of replacement of the rotary atomizer system. There are three replacements presented with four possible options:

1. Upstream Venturi Scrubbers
2. Upstream Ejector Scrubbers
3. Downstream Ejector Scrubbers
4. Downstream Wet ESPs

The two upstream options 1., and 2., will require relocation of the switchboard, replacement of quenchers, replacements of fans, and a redesigned absorber control system. The installed system equipment costs for the upstream options including the relocation costs are estimated at $2,400,000 (venturis) and $2,550,000 (ejectors). Upstream systems offer the advantage of removing the particulate prior to the absorption tower, thereby reducing solids accumulation in the tower, which creates an operational problem for the tower. Superior suggested that the estimated impact on production is considerably lower since most of the equipment can be installed without having to shut down the furnaces or curtail furnace operating rates.

The particulate characteristics in the scrubbing liquor such as dissolved solids and mist are a continuing problem for particulate removal in the current system and might pose a similar problem for the venturis. Superior suggests that the ejectors need pilot testing due to the higher uncertainty of the solids particulate collection for this application.

Venturis can provide a overall removal efficiency of 95%. Superior estimated that the total capitol cost for Venturis including the amount already invested in particulate control improvements since 1994, would be $3,710,000. The total particulate estimated from the furnace operation, which is subject to PSD, is estimated to be 72.73 tons per year. Assuming 95% control, the venturis will cost $54,000 per ton of particulate controlled. The annual operating and maintenance costs are estimated to be $783,000. Based on the above study, the Division has ruled this option out as it is not cost effective.

Upstream ejectors are capable of efficient particulate control, especially in the sub-micron range. Superior estimated that the total capitol cost for ejectors, including the amount already invested in particulate control improvements since 1994, will be $3,910,000. The total particulate estimated from the furnace operation that is subject to PSD is estimated to be 72.73 tons per year. Assuming 95% control, the venturis will cost $56,500 per ton of particulate controlled. The annual operating and maintenance costs are estimated to be $825,000. Based on the above study, the Division has ruled this option out as it is not cost effective.

Neither the upstream venturis nor the ejectors will improve the existing problem of solids carryover in the entrained mist downstream of the scrubber.

Option 3, downstream ejector scrubber would replace the existing rotary atomizers. The downstream ejectors will need a high degree of demisting to ensure minimal mist carry over in light of the high liquid flow rates in the ejectors. This will necessitate use of disengagement vessels and demisters. The downstream ejectors will have similar particulate control as upstream ejectors. Superior estimated that the total capitol cost for ejectors including the amount already invested in particulate control improvements since 1994 will be $3,360,000. The Division did not verify the cost estimates submitted by Superior. The total particulate estimated from the furnace operation that is subject to PSD is estimated to be 72.73 tons per year. Assuming 95% control, the ejectors will cost $48,500 per ton of particulate controlled. The annual operating and maintenance costs are estimated to be $705,000. Based on the above study, the Division has ruled this option out as it is not cost effective.

Option 4, Wet ESP downstream of the absorbers, has been demonstrated to collect hard-to-collect solids and will also remove mist. The equipment will replace the existing rotary atomizer/demisting systems. The ESP, however, requires fresh water for continuous flogging of the collector tubes to remove captured particulate. Also, there is a flushing system that will be used infrequently and can use the filtered recycle water. Superior is suggesting that the likely average of continuous water requirement should be 3 gpm or less but cannot be guaranteed a *priori*. If the requirement of the fresh water is more, then it will create a water imbalance in the absorber tower and the excess water needs to be bled and this excess water would require a waste water treatment plant as it cannot be directly disposed. This option definitely seems to be the best replacement option considering the probable technical feasibility. This option can be studied more for technical feasibility. However, Superior estimated that the total capitol cost for ESP would be $3,960,000. The total particulate estimated from the Furnace operation that is subject to PSD is estimated to be 72.73 tons per year. Assuming 95% control, the ESPs will cost $57,500 per ton of particulate controlled. The annual operating and maintenance costs are estimated to be $865,000. Based on the above study, the Division has ruled this option out, as it is not cost effective.

The Division agrees with Superior's contention that the potential uncontrolled SO2 emissions (4200 TPY uncontrolled) from the plant far exceed the potential PM10 emissions (Current emissions of 72.73 TPY) and the technology selected for the particulate control should be able to work in conjunction with the technology selected for SO2 control (the existing dual alkali scrubber). The Division recommends that Superior continue using current particulate controls along with the other BACT requirements as described for Desulco Furnaces 16-01 or 16-02, 16-03, 16-04 and 16-05 while venting through the New Scrubber NS01.

Based on the above analysis the Division has determined that the following will be the BACT for particulate control:

1. The emissions of particulate matter from the Absorber Tower stack shall not exceed 19.2 lb/ton of raw material and 72 TPY.

2. The Multiclone, Quench Reactor, Dual Alkali Scrubber, Hydroclone, Four Rotary Atomizers with upstream and downstream Demisters shall control particulate emissions (PM_{10}) and sulfur dioxide emissions and shall be operated properly in accordance with manufacturer's specifications and/or standard operating procedures at all times any of the emissions units [Furnaces 16-01 or 16-02, 16-03, 16-04, and 16-05] listed above are in operation, except when Furnaces 16-01 and 16-02

are venting to the dry control system and none of the other furnaces are in operation. [BACT limit]

3. The permittee shall, twice during the life of the permit, review the latest scrubber downstream particulate controls (e. g., demisters/rotary atomizers), which are available on the market and determine if the new products will better control particulate. The first evaluation shall be done within three months after the first anniversary of Title V permit issuance; The second during the third year of the permit. A report shall be submitted to the Permit Review Branch and to the Paducah Regional Office after each evaluation. The report shall include any proposed changes and the timetable for making those changes. If no changes will be made, the report shall document the evaluations and findings of the evaluation. Pursuant to the requirements of 401 KAR 51:017, the Division shall require changes to the scrubber downstream controls, if reasonable, available and practical control equipment is found. [BACT Limit]

5. Air Quality Impact Analyses

Pursuant to Regulation 401 KAR 51:017, Section 12, an application for a PSD permit shall contain an analysis of ambient air quality impacts in the area that the proposed facility will affect for each pollutant that the facility will have the potential to emit in significant amounts as defined in Section 22 of the same regulation. The purpose of this analysis shall be to demonstrate that allowable emissions from the proposed source will not cause or contribute to air pollution in violation of:
(i) A national ambient air quality standard in an air quality control region; or
(ii) An applicable maximum allowable increase over the baseline concentration in an area.

With respect to a pollutant for which no ambient air quality standard exists, the analysis shall contain the air quality monitoring data the Division determines necessary to assess ambient air quality for that pollutant in an area that the emissions of that pollutant will affect.

Pollutant	Significant Emissions Rate[(1)] (tpy)	Significant Net Emission Increase [2] (tpy)
Carbon Monoxide	100	73.87

Pollutant	Significant Emissions Rate(1) (tpy)	Significant Net Emission Increase 2 (tpy)
Nitrogen Oxides	40	1.56
Sulfur Dioxide	40	-1.67
PM_{10}	15	72.73

(1) Significant emission rate given in Regulation 401 KAR 51:107, Section 22.
(2) Based on controlled emission rates.

As indicated in the table above, the proposed modification will result in a significant net emissions increase in excess of the significant net emission rates for particulate matter. The source was therefore required to conduct an air quality impact analysis for particulate matter.

Note on New Ambient Air Quality Standards:
Effective September 16, 1997, U.S. EPA promulgated new and revised ambient air quality standards for ozone and particulate matter. These have been summarized in the table below:

Pollutant	Existing Standard	New Standard
Ozone (O_3)	0.12 ppm (1-hour average)	0.08 ppm (8-hour average)
$PM_{2.5}$	None	15 $\mu g/m^3$ (annual average)
	None	65 $\mu g/m^3$ (24-hour average)
PM_{10}	50 $\mu g/m^3$ (annual average)	50 $\mu g/m^3$ (annual average)
	150 $\mu g/m^3$ (24-hour average)	150 $\mu g/m^3$ (24-hour average)*

*Although the standard is the same, the form has been revised to 99th percentile concentration (3-year average).

To address the applicability of these new standards to the PSD review of Superior's proposed modifications, the Division has relied upon the following guidance provided by U.S. EPA:

i. Memorandum from John S. Seitz, Director, Office of Air Quality Planning and Standards - *Interim Guidance for Implementing Major New Source Review (NSR) Requirements for the Existing and New National Ambient Air Quality Standards for Ozone and Particulate Matter (PM)*.
ii. Memorandum from John S. Seitz, Director, Office of Air Quality Planning and Standards - *Interim Implementation of New Source Review Requirements for $PM_{2.5}$*.

Based on the guidance provided in these memoranda, the Division has reviewed the ambient air quality analysis for this facility taking into consideration the following:

i. Given the significant technical difficulties that exist with respect to $PM_{2.5}$ monitoring, emissions estimation, and modeling at this time, PM_{10} has been used as a surrogate for $PM_{2.5}$ in meeting the NSR requirements. For the purposes of this review, compliance with the PM_{10} standards has been deemed to be compliance with the $PM_{2.5}$ standards.
ii. Because the revised 24-hour PM_{10} standard is less stringent than the existing standard, the ambient air quality analysis based on the existing standard was the only analysis required. This analysis was deemed to be adequate for satisfying both existing and revised standards.

a. Modeling Methodology

The application for the proposed modifications contains an air dispersion modeling analysis for the criteria pollutant (PM_{10}) to determine the maximum ambient concentrations attributable to facility emissions for that pollutant for comparison with:

(1) The ambient significant levels (SIL) found in Table C-4 of the New Source Review Manual (Draft October 1990);
(2) The significant monitoring concentrations (SMC) found in 401 KAR 51:017, Section 24;
(3) The PSD increments and National Ambient Air Quality Standards (NAAQS) found in 401 KAR 51:107, Section 23 and 401 KAR 53:010, Ambient air quality standards, respectively (see also Note on new standards above).

Based on accepted U.S. EPA procedures, if the maximum predicted impacts for any pollutant are below the SILs, then it is assumed that the proposed facility cannot cause or contribute to a violation of the PSD pollutant increments or the national ambient air quality standards (NAAQS). Therefore, no further modeling would be required for such a pollutant. The applicant may also be exempted from the ambient monitoring data requirements if the impacts are below the SMCs.

The EPA's Industrial Source Complex Short Term model (ISCST3, Version) was used in the analysis. The ISCST3 model fulfills the requirements of Supplement C of the Guideline on Air Quality Models (Appendix W to 40 CFR Part 51). All parameters used in the modeling analysis for each pollutant have been found to be satisfactory and consistent with the prescribed usage for this model. Per EPA guidance, the ISCST3 model was run in sequential hourly mode using five consecutive years of meteorological data. Surface data used was based on weather observations taken at the Nashville, Tennessee, Weather Service (TWS) station for the period from 1987 through 1991. Concurrent upper air data was not available at TWS. Only 1987, 1990, 1991 upper air data was available. Therefore, to facilitate the use of five years worth of meteorological data, Superior used upper air data from nearby stations. The 1989 upper air data was obtained from Paducah, Kentucky and 1988 data was obtained from Wright-patterson Air Force Base weather station near Xenia, Ohio.

b. Modeling Results - Class II Area Impacts

The PSD requirements provide for a system of area classifications that determine the amount of growth allowed before significant air quality deterioration is deemed to occur. Class I areas have the smallest increments and allow the least growth. The impacts of the proposed project on the nearest Class I areas will be discussed in the next section. The proposed facility will be located in a Class II area that allows moderate growth. The results of the modeled impacts on the Class II have been presented in the table below:

Pollutant	Averaging Period	Calculated[1] Impact ($\mu g/m^3$)	SIL[2] ($\mu g/m^3$)	SMC[3] ($\mu g/m^3$)	PSD Class II Increments ($\mu g/m^3$)
PM_{10}	24-hour	9.93	5	10	30
	Annual	1.18	1	NA	17

(1) Maximum of 1987 through 1991 modeling
(2)Significant Impact Level [Ref: 40 CFR 51.165 (b) (2)]
(3)Significant Monitoring Concentration [Ref: 401 KAR 51:017]

c. Preconstruction Monitoring
<u>PM_{10}</u> - There is no new construction being authorized with this application. The permit authorizes production increase and four-furnace operation through the wet scrubber. However, the maximum predicted impacts for PM_{10} from the Superior facility are below their corresponding SMCs, no preconstruction ambient air quality monitoring was required for this pollutant.

d. Full Impact Analysis
<u>Pollutants</u> - Since the Superior's impact for PM_{10} is predicted to be greater than it's Significant Impact Levels (SILs), a full impact analysis was required for PM_{10}.
<u>Sources</u> - All sources that were permitted after January 6, 1975 have been included in the full impact analysis. These significant sources were identified by researching the Emissions Inventory System for the Kentucky counties that are within a 50-kilometer radius of Superior. To determine which facilities were likely to contribute to ambient air quality impacts on the NAAQS (and were, therefore, significant), the 20D screening technique developed by the North Carolina Division of Environmental Management was used. Finally, all sources with potential emissions less than 1.0 tons per year were considered insignificant.

As part of the PSD increment analysis, the company is required to determine if the Minor Source Baseline date (MSBD) has been triggered. The Minor Source Baseline date is the earliest date after the trigger date on which a complete PSD application is <u>received</u> by the permit reviewing agency. The trigger date for PM (Same for PM_{10}) is August 7, 1977. The application submitted by Superior Graphite on June 1, 1979, for the installation of two electric graphite furnaces and related material handling equipment (Log # 5013, Permit no: C-79-72), is a complete PSD application in the area. The regulations 40 CFR 52.21, Prevention of significant Deterioration and 401 KAR 51:015 (June 6, 1979 version of state PSD regulation) were applicable for this construction as the uncontrolled particulate and SO_2 emissions from the proposed construction exceeded 100 TPY. Thus, the MSBD has been established for both PM_{10} and SO_2 (July 1, 1979).

For the PSD increment consumption assessment, the PSD regulation requires emission inventories of all increment consuming sources within the baseline area (Christian County). As the MSBD has been established, the increment emission inventory also includes actual emissions increases at any stationary source, area source, or mobile source occurring after the MSBD along with all the major sources and changes at major sources permitted after January 6, 1975. To determine which facilities were likely to contribute to increment (and were, therefore, significant), the 20D screening technique was used.

A table of the significant facilities for PM_{10} considered in the full impact analysis modeling is presented below. If a source is in NAAQS inventory and not in PSD increment analysis inventory or if the emissions are different in PSD increment inventory, it is listed in the brackets.

Name	PM_{10} (tpy)(PSD tpy if different)	Distance (km)
Superior Graphite Company	106.21	0
UCAR Carbon Company	120.35	32.5
ALCAN	92.43	35.2
Andalex Resources Inc., Madisonville	<20D	45.1
Charolais Coal Company, Madisonville	<20D	38.3
Magic Coal Company, Madisonville	<20D	40.2
Sunrise Coal Incorporated, Greensville	<20D	32.7
Charcolais Corporation, Madisonville	<20D	32.8
Kentucky Stone Company, Princeton	<20D	43.6
Hopkinsville Milling Company, Hopkinsville	40.099	10.9
Irving Materials, Inc., Oak Grove	<20D	19.0
Hopkinsville Milling Co. , Hopkinsville	13.39 (<20D)	3.1
Siemer Milling Co.	17.767	1.3
Speciality Rock Products, Princeton	<20D	43.6
Bremmer, Inc, Princeton	<20D	49.3
Southwestern Tobacco Co, Hopkinsville	<20D	3.6
Freudenberg Nonwovens Ltd., Hopkinsville	6.578	1.2
Hopkinsville Elevator Co, Hopkinsville	13.902	1.6
Kentech Plastics Inc., Hopkinsville	2.070	0.7
Thomas Industries Inc, Hopkinsville	<20D	4.2
HQ 101st Airborne Div, Ft. Campbell	<20D	20.3
Phelps Dodge Magnet wire, Hopkinsville	2.318	0.7
Mid-Continent Spring Co, Hopkinsville	3.266	3.1
Autostyle Plastics, Inc., Hopkinsville	31.748	0.8
Ebonite International, Hopkinsville	<20D	5.7
U.S. Tobacco Company, Hopkinsville	<20D	6.3
Roger Group, Inc, Hopkinsville	15.452 (<20D)	3.4
Copar Inc. Hopkinsville	13.937	3.0

Name	PM_{10} (tpy)(PSD tpy if different)	Distance (km)
Dana Corporation, Hopkinsville	3.902	1.6
Rockwell International, Hopkinsville	1.257	3.0
Hopkinsville Elevator Inc., Hopkinsville	<20D	5.5
Emerson Electric Co., Russellville	<20D	48.3
Carpenter Co, Russellville	<20D	49.8
Agri-Chem, Hopkinsville	<20D	3.8
Internaitonal Paper, Hopkinsville	0.029	2.3
Continental Grain Company	16.272	2.7
AG Spray Equipment, Hopkinsville	0.021	1.5
Original Exhaust Mfg, Inc., Hopkinsville	1.733	2.4
EMS-Togo Corp, Hopkinsville	<20D	4.2
Woodbury Corp, Hopkinsville	<20D	3.3
Plymouth Tube Company, Hopkinsville	0.486	1.0
Griffin Industries , Russellville	<20D	49.6
J S Technos Corporation , Russellville	<20D	49.6
Ressellville Elevator , Russellville	<20D	45.5
Road Builders Inc., Greenville	<20D	36.1
Rogers Group	430.95	1.3

<u>NAAQS</u>: As specified in 401 KAR 51:017, Prevention of Significant Deterioration of Air Quality, no concentration of a regulated pollutant shall exceed either its secondary or primary ambient air quality standards for that pollutant. The following sources were modeled, a.) All sources of particulate matter at Superior b.) All particulate matter sources within Superior's SIA, and c.) All nearby sources expected to have a significant impact within Superior's SIA. All the sources were modeled using the source wide potential emissions of particulate matter. The modeling with ISCST3 indicates a 57.55 µg/m^3 (24-hour average) from all sources at this location. The background concentration for this area is 49 µg/m^3, therefore the NAAQS standard (150 µg/m^3) is being met. The highest impact is 8.63 µg/m^3(Annual average) from all the sources at this location. The background concentration for this area is 21 µg/m^3. Therefore the NAAQS (50 µg/m^3) is being met.

Pollutant	Period	Background Concentration (µg/m$^{3)}$	Impact All Sources (µg/m^3)	Predicted Ambient Impact (µg/m^3)	NAAQS (µg/m^3)

Pollutant	Period	Background Concentration ($\mu g/m^3$)	Impact All Sources ($\mu g/m^3$)	Predicted Ambient Impact ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
PM_{10}	Annual	21.0	8.63	29.63	50
	24 hour	49.0	57.55	106.55	150

e. Modeling Results - Increment consumption.
A PSD increment is the maximum increase that is allowed to occur above a baseline concentration for a pollutant. The minor source baseline for PM_{10} was established on June 1, 1979 by Superior Graphite Company. The results of the increment consumption analysis are shown below:

Pollutant	Averaging Period	Increment Consumed ($\mu g/m^3$)	PSD Class II Increments ($\mu g/m^3$)
PM_{10}	24-hour	14.52	30
	Annual	3.46	17

All the sources with significant increases after the submittal of Superior's PSD application are considered in the modeling for increment analysis.

The model did show predicted exceedences of the 24-hour PM_{10} increment standard. The applicant performed a spatial analysis demonstrating that PM_{10} emissions from Superior are below the significant impact level (SIL) in all the modeled violations. In addition, the Division has reviewed the modeled violations for individual source contributions, and determined that Venture Western Michigan (Venture), previously known as Autostyle Plastics is the major contributor (99% at 14 of 15) at the 15 violations that were found. Venture's modeling input was based on the potential to emit of 7.214 lb/hr of PM10. This information was taken from the Division's emissions database. However, the Division is in the process of issuing a Title V permit for Venture and has recalculated the emissions from the facility and found that the potential particulate emissions (PM10) after controls are 2.77 lb/hr of PM10. The emissions of 2.77 lb/hr will get the increment down to 14.52 $\mu g/m^3$. The Division is going to limit PM10 emissions in the Venture Title V permit to have the increment below 30 $\mu g/m^3$. This will insure that the modeled increment is below the standard of 30 $\mu g/m^3$.

f. Modeling Results - Class I Area Impacts
The nearest Class 1 area is Mammoth Cave National Park located 110 kilometers North-East from the site. The modeling has been performed to see if the proposed modification would have a significant impact on that Class I area. The standard of 0.07 ug/m3 for the 24-hour averaging period that is proposed by National Parks Service has been used to check for significant impact. The maximum Class I area impact due to particulate emissions from Superior Graphite Company is shown to be 0.053 ug/m3, which is less than even the proposed significant impact level of 0.07 ug/m3. Since the ISCST3 model was used to determine this impact, this value should be very conservative since ISCST3 tends to over- estimate significantly when modeling sources over 50 km away from the receptor grid. Therefore, no further analysis of Class I area ambient impact is required for this proposed modification.

g. Modeling Results - Air Toxics Analysis
The proposed construction will not emit significant amounts air toxics regulated under Kentucky State Regulation 401 KAR 63:020, Potentially hazardous matter or toxic substances. Therefore, no further analysis was warranted.

6. Additional Impact Analyses

a. *Construction and related emissions* - The proposed modification does not address any new construction, and no impact analysis due to construction and related emissions is warranted.
b. *Growth Analysis* - The proposed modification does not address any new construction, and no impact analysis on area growth is warranted. The only effect the proposed modification will have is to assure that the current impact of Superior Graphite on the local economy, including the employment of 100 persons, will be maintained.
c. *Soils and Vegetation Impacts Analysis* - The maximum predicted ambient concentrations due to the existing sources and proposed modification at Superior are below the ambient air quality standards and are not expected to have any significant impacts on soil and vegetation in the area. Also, the area surrounding Superior is industrial and no agricultural or recreational areas will see any effects from emissions of particulate matter from this facility.
d. *Visibility Impairment Analysis* - The nearest Class I area (Mammoth Cave National Park) is located approximately 110 kilometers east-north east of the Superior. Impacts on the visibility in this Class I area are expected to negligible. However, a Level 1 visibility screening analysis was conducted to evaluate the potential for significant impact at Mammoth Cave National Park. This Level 1 analysis was performed using the VISCREEN model for evaluation of plume visual impacts. The model estimates the color difference parameter (Delta E) and the plume contrast using three wavelengths of light for plumes against a sky background and against a terrain background. VISCREEN is designed to calculate these parameters for emissions sources of particulate and compared to screening criteria of 2.0 for Delta E and 0.05 for green contrast. The maximum Delta E value found was 0.097 and a maximum contrast of 0.001. Since these values are far below the Level 1 screening thresholds, the proposed modification is verified to have a minimal visibility impairment potential for Mammoth Cave National Park, the nearest Class I area.